CHAPTER 6.1.

CONTROL OF HAZARDS IN AQUATIC ANIMAL FEEDS

Article 6.1.1.

Introduction

One of the key objectives of the Aquatic Code is to help OIE Members trade safely in aquatic animals and aquatic animal products by developing relevant aquatic animal health measures. These recommendations address aquatic animal health hazards and food safety hazards in aquatic animal feed. A key objective is to prevent the spread, via aquatic animal feed, of diseases from an infected country, zone or compartment to a free country, a free zone or a free compartment.


Key considerations relevant to aquatic animal feed are as follows:

1. Concentration of aquaculture establishments heightens the risk of disease transmission, whether the pathogen enters the culture system via feed or other means.

2. For many aquatic animal species, predation (including cannibalism) is their natural way of feeding in their natural habitat.

3. Historically, animal proteins used in feed were mainly sourced from the marine environment, due to the nutritional needs of aquatic animals and for reasons of economy. This practice increases the risk of disease transmission, especially when aquatic animals are fed live or whole aquatic animals of the same or related species. There are many examples of this type of practice, e.g. early stage crustaceans fed on Artemia species and aquaculture tuna fed on whole wild caught fish.

4. The usage of feed in moist form (moisture content equal to or greater than 70%), semi-moist form (moisture content between 15 and 70%), and dry form (a moisture content equal to or less than 15%) implies different levels of risk due to the processing applied to the feed.
5. With the increasing number of species being farmed (especially marine finfish), the use of live feed and moist feed has increased. It is likely that these industries will in future use formulated feed as appropriate technologies are developed.

6. Hazards may be transmitted from feed to aquatic animals via direct or indirect means. Direct transmission occurs when the cultured species consumes feed containing a pathogenic agent (e.g. shrimp larvae consuming rotifer contaminated with white spot syndrome virus) while indirect transmission refers to pathogens in feed entering the aquatic environment or infecting non target species, and thereby establishing a mechanism for indirect infection of the species of commercial interest. Pathogens that are less host-specific (e.g. white spot syndrome virus, *Vibrio* species) present a greater risk of indirect transmission as they can establish reservoirs of infection in multiple species.

7. As new species become the subject of aquaculture, new pathogens emerge in association with these hosts. The expression of disease may be facilitated by culturing species under intensive and novel conditions. Also, it is necessary to conduct research and develop new feed (and feed ingredients) that are appropriate to the species and its culture system. As more and more aquatic animal species are being cultured, it is difficult to make recommendations for all pathogenic agent/host species combinations.

**Article 6.1.2.**

**Scope**

These recommendations document risk mitigation measures, including traceability and certification, to deal with aquatic animal health risks associated with trade in aquatic animal feed and feed ingredients. They recommend the control of hazards through adherence to recommended practices during the production (harvest, handling, storage, processing and distribution) and use of both commercial and on-farm produced feed (and feed ingredients) for aquatic animals. Hazards include pathogens that cause OIE listed diseases and other agents that cause an adverse effect on animal and/or public health. While aquatic animals grown for food are the main focus, the same principles apply to feed for aquatic animals used for other purposes.

**Article 6.1.3.**

**General principles**

1. **Roles and responsibilities**

   The Competent Authority has the legal power to set and enforce regulatory requirements related to animal feed, and has final responsibility for verifying that these requirements are met. The Competent Authority may establish regulatory requirements for relevant parties, including requirements to provide information and assistance. Refer to Chapter 3.1. of the Aquatic Code.

   It is a particular responsibility of the Competent Authority to set and enforce the regulatory requirements pertaining to the use of veterinary drug products, aquatic animal disease control and the food safety aspects that relate to the management of live aquatic animals on farm.

   Those involved in the production and use of animal feed and feed ingredients have the responsibility to ensure that these products meet regulatory requirements. All personnel involved in the harvest, manufacture, storage and handling of feed and feed ingredients should be adequately trained and aware of their role and responsibility in preventing the spread of hazards. Appropriate contingency plans should be developed in case of a feed-borne outbreak of disease. Equipment for producing, storing and transporting feed should be kept clean and maintained in good working order.
Private veterinarians and others (e.g. laboratories) providing specialist services to producers and to the feed industry may be required to meet specific regulatory requirements pertaining to the services they provide (e.g. disease reporting, quality standards, transparency).

2. Regulatory standards for feed safety

All feed and feed ingredients should meet regulatory standards for feed safety. Scientific evidence, including the sensitivity of analytical methods, and on the characterisation of risks, should be taken into account in defining limits and tolerances for hazards.

3. Risk analysis

Internationally accepted principles and practices for risk analysis (see Section 2. of the Aquatic Code and relevant Codex texts) should be used in developing and applying the regulatory framework.

A generic risk analysis framework should be applied to provide a systematic and consistent process for managing hazards.

4. Good practices

Where national guidelines exist, good aquaculture practices and good manufacturing practices (including good hygienic practices) should be followed. Countries without such guidelines are encouraged to develop them or adopt suitable international standards or recommendations.

Where appropriate, Hazard Analysis and Critical Control Point (HACCP; as defined in the Annex to the Recommended International Code of Practice on General Principles of Food Hygiene [CAC/RCP 1-1969]) principles should be followed to control hazards that may occur in feed.

5. Relationship between prions and aquatic animal species

Scientific knowledge is lacking on the relationship between prions and aquatic animal species. There is no evidence to suggest that the use of terrestrial animal by-products as ingredients in aquatic animal feed as currently practiced in aquaculture gives rise to risks in respect of prion diseases. More scientific information is desirable to enable aquaculture industries to utilise more terrestrial animal by-products as a means of reducing dependency on aquatic protein and lipid sources.

6. Bioaccumulation

Chemical hazards, such as heavy metals, dioxins and polychlorinated biphenyls (PCB) persist in certain tissues and therefore tend to accumulate through the food chain.

7. Geographic and environmental considerations

Aquatic and terrestrial harvest areas for feed should not be located in proximity to sources of animal health or food safety hazards. Where this cannot be avoided, preventive measures should be applied to control risk. The same recommendations apply for the processing of feed and the location of aquaculture establishments.

Aquatic animal health considerations include factors such as disease status, location of quarantined premises, existence of processing plants without proper biosecurity measures and the existence of zones/compartments of specified health status.
Public health considerations include factors such as the use of fertiliser in the production of microalgae, industrial operations and waste treatment plants that generate pollutants and other hazardous products. The potential accumulation of pollutants in the food chain through feed needs to be considered.

8. **Zoning and compartmentalisation**

Feed is an important component of biosecurity and needs to be considered when defining a compartment or zone in accordance with Chapter 4.1. of the Aquatic Code.

9. **Sampling and analysis**

Sampling and analytical protocols for feed should be based on scientific principles and procedures, and OIE standards where applicable.

10. **Labelling**

Labelling should be clear and informative on how the feed and feed ingredients should be handled, stored and used and should comply with regulatory requirements. Labelling should provide for trace back. See Section 4.2. of the Codex Code of Practice on Good Animal Feeding (CAC/RCP 54-2004).

Labelling should be informative, unambiguous, legible and conspicuously easily visible placed on the package if sold in package form and on the waybill and other sales accompanying documents if sold in bulk, un-packaged form, and should comply with regulatory requirements and Section 4.2. Labelling of Codex Code of Practice on Good Animal Feeding (CAC/RCP 54-2004), including listing of ingredients and instructions on the handling, storing and use. All claims made on a label should be able to be substantiated.

11. **Design and management of inspection programmes**

In meeting animal and public health objectives prescribed in national legislation or required by importing countries, Competent Authorities contribute through the direct performance of some tasks or through the auditing of animal and public health activities conducted by other agencies or the private sector.

Operators in the feed and feed ingredients business and other relevant industries should implement procedures to ensure compliance with regulatory standards for harvest, handling, storage, processing, distribution and use of feed and feed ingredients. Operators have full responsibility for implementing systems for quality control. Where such systems are applied, the Competent Authority should verify that they meet all regulatory requirements.

12. **Assurance and certification**

Feed business operators manufactures are responsible for demonstrating assuring the safety of their feed products establishments under their control. Competent Authorities are responsible for providing assurances domestically and to trading partners that regulatory requirements have been met. For international trade in aquatic animal product based feed, Competent Authorities are required responsible to provide international aquatic animal health certificates.
13. **Hazards associated with aquatic animal feed**

a) **Biological hazards**

Biological hazards that may occur in *feed* and *feed ingredients* include agents such as bacteria, viruses, fungi and parasites. The scope of these recommendations covers *OIE listed diseases* and other agents that cause an adverse effect on animal and/or public health.

b) **Chemical hazards**

Chemical hazards that may occur in *feed* and *feed ingredients* include naturally occurring chemicals (such as mycotoxins, gossypol and free radicals), industrial and environmental contaminants (such as heavy metals, dioxins and PCBs), residues of veterinary *drugs*, products, and pesticides and radionuclides.

c) **Physical hazards**

Physical hazards that may occur in *feed* and *feed ingredients* include foreign objects (such as pieces of glass, metal, plastic or wood).

14. **Contamination**

Procedures to minimise the risk of contamination during the production, processing, storage, distribution (including transport) and the use of *feed* or *feed ingredients* should be included in current regulations and standards. Scientific evidence, including the sensitivity of analytical methods and on the characterisation of risk, should be drawn upon in developing this framework.

Procedures such as flushing, sequencing and physical clean-out should be used to avoid cross-contamination between batches of *feed* or *feed ingredients*.

15. **Antimicrobial resistance**

Concerning the use of antimicrobials in animal *feed* refer to Section 6.X. of the *Aquatic Code* (under development study).

16. **Management of information**

The *Competent Authority* should establish requirements for the provision of information by the private sector in accordance with the regulatory framework.

The private sector should maintain records, in a readily accessible form, on the production, distribution, importation and use of *feed* and *feed ingredients*. These records are required to facilitate the prompt trace-back of *feed* and *feed ingredients* to the immediate previous source, and trace-forward to the next/subsequent recipients, to address aquatic animal health and/or public health concerns. The private sector should provide information to the *Competent Authority* in accordance with the regulatory framework.

Animal identification (in the case of *aquatic animals* this will normally be on a group basis) and traceability are tools for addressing animal health and food safety risks arising from animal *feed* (see Chapters 4.1. and 4.2. of the OIE *Terrestrial Animal Health Code*, Section 4.3 of CAC/RCP 54-2004).
Article 6.1.4.

Recommended approaches to aquatic animal health risk mitigation

1. Commodities

   a) Safe commodities

       Some commodities undergo extensive processing such as heat treatment, acidification, extrusion and extraction. There may be a negligible risk that pathogens will survive in such products if they have been produced in accordance with Good Manufacturing Practice. Such aquatic animal products are listed in disease-specific chapters in the Aquatic Code in Article X.X.3.

   b) Other commodities not listed as safe commodities

       Competent Authorities should consider the following risk mitigation measures:

       i) sourcing feed and feed ingredients from a disease-free country, free zone or free compartment; or

       ii) confirmation (e.g. by testing) that pathogens are not present in the commodity; or

       iii) treatment (e.g. by heat or acidification) of the commodity using a method approved by the Competent Authority to inactivate pathogens; or

       iv) use of feed only in populations that are not susceptible to the pathogen(s) in question and where aquatic animals that are susceptible to the pathogen(s) in question will not come into contact with the feed or its waste products.

       In addition, risks associated with the disposal of effluents and waste material from feed processing plants and aquaculture establishments should be considered.

   c) Whole fish (fresh or frozen)

       The practice of trading fresh or frozen whole marine fish for use as aquatic animal feed presents a significant risk of introducing diseases into populations and should be avoided where possible. Risk mitigation measures include sourcing fish only from stocks where there is no evidence of infection with any of the OIE listed diseases or treatments that inactivate aquatic animal pathogens.

2. Feed production

   To prevent contamination by pathogens during production, storage and transport of feed and feed ingredients:

   a) flushing, sequencing or physical clean-out of manufacturing lines and storage facilities should be performed between batches as appropriate;

   b) buildings and equipment for processing and transporting feed and feed ingredients should be constructed in a manner that facilitates hygienic operation, maintenance and cleaning and prevents contamination;

   c) in particular, feed manufacturing plants should be designed and operated to avoid cross-contamination between batches;
d) processed feed and feed ingredients should be stored separately from unprocessed feed ingredients, under appropriate storage conditions;

e) feed and feed ingredients, manufacturing equipment, storage facilities and their immediate surroundings should be kept clean and pest control programmes should be implemented;

f) measures to inactivate pathogens, such as heat treatment or the addition of authorised chemicals, should be used where appropriate. Where such measures are used, the efficacy of treatments should be monitored at appropriate stages in the manufacturing process;

g) labelling should provide for the identification of feed and feed ingredients as to the batch/lot and place and date of production. To assist in tracing feed and feed ingredients as may be required to deal with animal disease incidents, labelling should provide for identification by batch/lot and place and date of production.

3. Importing countries

**Competent Authorities** should consider the following measures:

a) imported feed and feed ingredients should be delivered to feed manufacturing plants or aquaculture facilities for processing and use under conditions approved by the Competent Authority;

b) effluent and waste material from feed manufacturing plants and aquaculture facilities should be managed under conditions approved by the Competent Authority, including, where appropriate, treatment before discharge into the aquatic environment;

c) feed that is known to contain pathogens should only be used in a zone or compartment that does not contain species susceptible to the disease in question;

d) the importation of raw unprocessed feed derived from aquatic animals to feed aquatic animal species should be avoided where possible;

e) introduction of internal measures to address the risks associated with raw commodities for human consumption being diverted to use as feed.

4. Certification procedures

When importing feed and feed ingredients of aquatic animal origin other than those mentioned in point 1a) of Article 6.1.4., the Competent Authority of the importing country should require that the consignment be accompanied by an international aquatic animal health certificate issued by the Competent Authority of the exporting country (or a certifying official approved by the importing country).

Specific provisions for OIE listed diseases may be found in relevant disease chapters of the Aquatic Code.

The certificate should be in accordance with the Model Certificate in Chapter 5.10.

**Article 6.1.5.**

**Certification procedures for feeds and feed ingredients of aquatic animal origin**

When importing feed and feed ingredients of aquatic animal origin other than those mentioned in point 1a) of Article 6.1.4., the Competent Authority of the importing country should require that the consignment be
accompanied by an international aquatic animal health certificate issued by the Competent Authority of the exporting country (or a certifying official approved by the importing country).

This certificate should certify:

1. that feed and feed ingredients of aquatic animal origin were obtained from a country, zone or compartment that is free from relevant aquatic animal diseases; or

2. that feed and feed ingredients of aquatic animal origin were tested for relevant aquatic animal diseases and shown to be free of these diseases; or

3. that feed and feed ingredients of aquatic animal origin have been processed to ensure that they are free of relevant aquatic animal diseases.

Specific provisions for OIE listed diseases may be found in relevant disease chapters of the Aquatic Code.

The certificate should be in accordance with the Model Certificate in Chapter 5.10, Article 6.1.6.

Risk pathways for pathogen transmission and contamination through harvest, manufacture and use of aquatic animal feed

1. Pathogens can be introduced into feed in the following ways:
   a) via the harvest of infected aquatic animals;
   b) during storage, processing and transport, due to poor hygienic practices, the presence of pests, or residues of previous batches of feed remaining in processing lines, containers or transport vehicles.

2. Aquatic animals can be exposed to pathogenic agents in feed in the following ways:
   a) Direct exposure
      The use of unprocessed feed derived from aquatic animals to feed aquatic animals presents a potential direct route of exposure. For example feeding salmonid offal to salmonids presents a heightened risk of disease transmission because tissue from a susceptible species is being fed to a susceptible species.
   b) Indirect exposure
      Pathogens in feed may be transmitted to aquatic animals in aquaculture and wild aquatic animals via contamination of the environment or infection of non-target species.

Figure 1 illustrates the possible pathways for transmission of pathogens within the feed production and utilisation process.

Feed ingredients of aquatic origin used in aquaculture can be a source of pathogens (viruses, bacteria and parasites) to cultured aquatic animal species. In aquaculture establishments pathogens in feed can infect the animals directly (via consumption of feed) or indirectly via environmental sources. Live feed and moist feed are more likely to contain pathogens because their ingredients are either in a raw state or subject to minimal treatment.

Feed and feed ingredients harvested from infected countries, zones or compartments may have a high pathogen load. Feed and feed ingredients from these sources should be processed (e.g. using heat or chemical treatments) to
reduce, or eliminate, the pathogen load. After processing care should be taken to avoid post processing contamination during storage and transportation of these commodities. For example, when two or more batches of ingredients of different sanitary status are handled, stored and/or transported together without appropriate biosecurity measures, there is a risk of cross-contamination of the feed.

An aquaculture facility can also be a source of pathogens in aquatic animal feed. For example, feed can be contaminated with pathogens through poor hygiene practices at an infected aquaculture establishment. If the feed is redistributed from the aquaculture facility to the manufacturing facility for recycling, or distributed to another farm, pathogens can be transferred to other aquaculture establishments.

Figure 1: Risk chart of pathogen transmission and contamination through harvest, manufacture and use of aquatic animal feed
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<thead>
<tr>
<th>LF</th>
<th>Live feed</th>
<th>Possibility for risk reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>MF</td>
<td>Moist feed</td>
<td></td>
</tr>
<tr>
<td>SF</td>
<td>Semi-moist feed</td>
<td></td>
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<tr>
<td>DF</td>
<td>Dry feed</td>
<td></td>
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<tr>
<td>+++</td>
<td>High risk of pathogen presence</td>
<td>Redistribution or recycling of finished feed</td>
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<tr>
<td>++</td>
<td>Moderate risk of pathogen presence</td>
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<tr>
<td>+</td>
<td>Low risk of pathogen presence</td>
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